

# DATA SHEET

## Mono-axial™ series **Leaded ceramic multilayer capacitors**

Product specification  
Supersedes data of 24th October 2001  
File under BCcomponents, BC06

2002 Sep 10

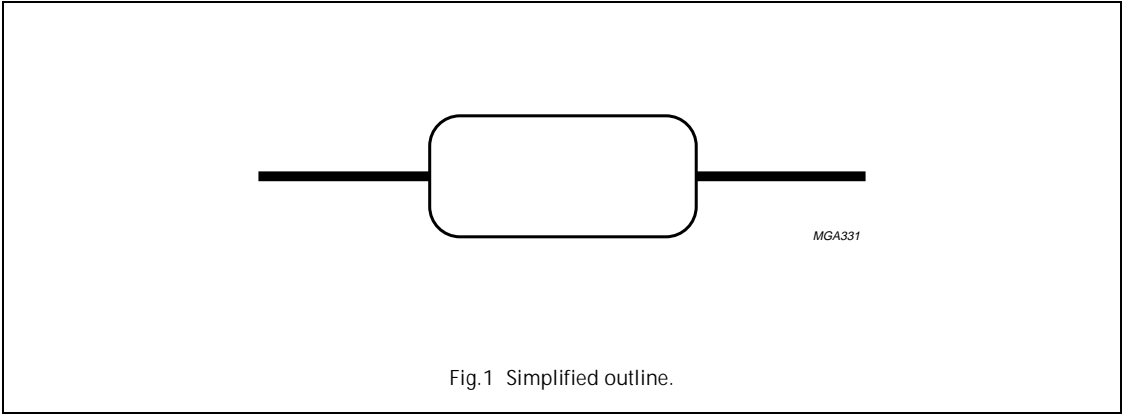
Leaded ceramic multilayer capacitors

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<b>FEATURES</b> <ul style="list-style-type: none"><li>• High capacitance per unit volume</li><li>• Low cost.</li></ul>	<b>DESCRIPTION</b> <p>The basic capacitor construction consists of ceramic dielectric materials processed into a tape with a typical thickness range from 0.025 to 0.076 mm. Metal electrode patterns are applied using a thick film screening process. Multiple layers are stacked and laminated in such a manner that electrodes are alternately exposed when the pattern is cut into individual chip capacitors. The capacitors are fired through a high temperature profile to mature the ceramic and metal into a homogeneous unit.</p>	<p>Metal end terminations are applied and fired to provide electrical connection between the individual layers. Tinned leads are attached using a solder. Encapsulation consists of a moisture resistant gold colour conformal epoxy coating that meets the flame requirements of “UL94V-0”.</p>
<b>APPLICATIONS</b> <p>These conformally coated axial leaded capacitors are designed for commercial and industrial applications in four dielectrics, NPO (ultra-stable), X7R (stable) and Z5U, Y5V (general purpose). Applications include timing, coupling/decoupling, signal comparison and biasing. Mono-axial™ capacitors are suitable for automatic insertion equipment.</p>		

QUICK REFERENCE DATA

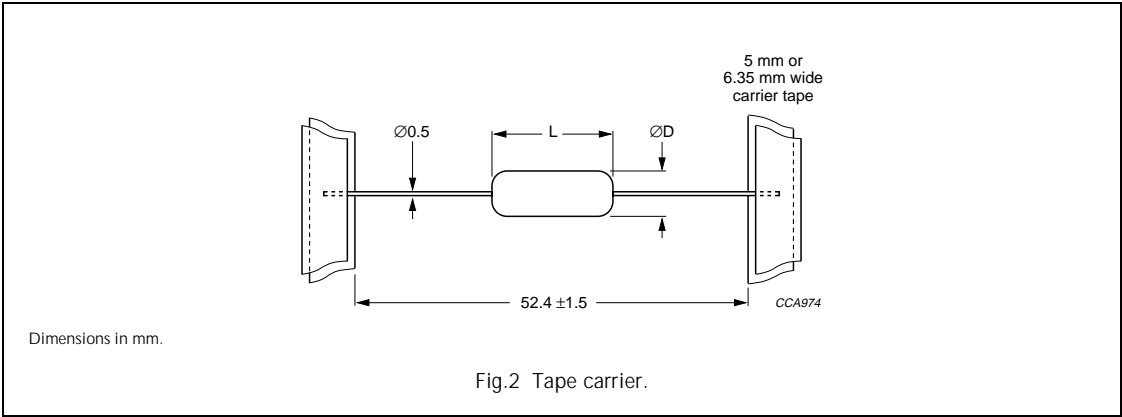
DESCRIPTION	VALUE							
	2252 205 .....	2252 206 .....	2252 225 .....	2252 226 .....	2252 245 .....	2252 246 .....	2252 262 .....	2252 265 .....
Capacitance range	10 to 5600 pF		100 pF to 0.22 µF		1000 pF to 1.0 µF		0.01 to 1.0 µF	
Rated DC voltage	50 V	100 V	50 V	100 V	50 V	100 V	25 V	50 V
Tolerance on capacitance	±5%		±10%		±20%		+80%/–20%	
Temperature coefficient	NPO		X7R		Z5U		Y5V	



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MECHANICAL DATA



Marking (see Fig.3)

Date code (DDD):

Three-digit code; first digit denotes year, last two denote week of manufacture.

941 = 1999, wk 41

Capacitance value (CCC):

10 pF to 99 pF; actual value in pF (2 digits only)

100 pF and above; coded capacitance value (same as used in P/N).

Capacitance tolerance (T):

Standard EIA tolerance (same as used in P/N).

Material code (M):

A = C0G

C = X7R

E = Z5U

Y = Y5V.

Voltage code (V):

1 = 100 V

3 = 25 V

5 = 50 V.

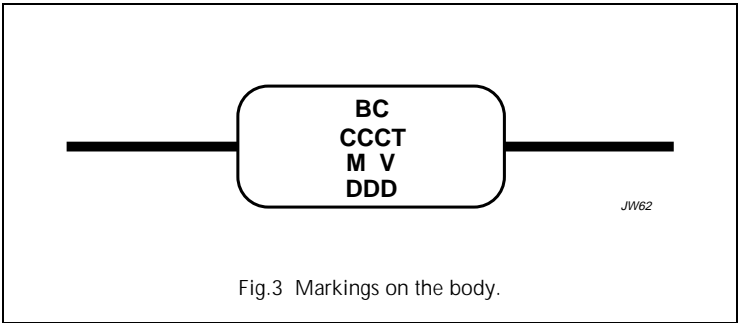
Physical dimensions

Table 1 Capacitor dimensions and mass

SIZE	L <sub>max</sub> <sup>(1)</sup> (mm)	ØD <sub>max</sub> <sup>(1)</sup> (mm)	MASS (g)
15	3.8 (0.150)	2.5 (0.100)	≈0.14
20	5.0 (0.200)	3.0 (0.120)	≈0.14

Note

1. Dimensions between parentheses are in inches.



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### CAPACITANCE RANGE CHARTS

#### NP0 Dielectric

CAP.	SIZE CODE 15		SIZE CODE 20	
	50 V	100 V	50 V	100 V
10 pF				
12				
15				
18				
22				
27				
33				
39				
47				
56				
68				
82				
100				
120				
150				
180				
220				
270				
330				
390				
470				
560				
680				
820				
1000				
1200				
1500				
1800				
2200				
2700				
3300				
3900				
4700				
5600				
6800				
8200				
0.01 µF				

#### X7R Dielectric

CAP.	SIZE CODE 15		SIZE CODE 20	
	50 V	100 V	50 V	100 V
100-220 pF				
270				
330				
390				
470				
560				
680				
820				
1000				
1200				
1500				
1800				
2200				
2700				
3300				
3900				
4700				
5600				
6800				
8200				
0.01 µF				
0.012				
0.015				
0.018				
0.022				
0.027				
0.033				
0.039				
0.047				
0.056				
0.068				
0.082				
0.10				
0.12				
0.15				
0.22				

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Z5U Dielectric

CAP.	SIZE CODE 15		SIZE CODE 20	
	50 V	100 V	50 V	100 V
1000 pF				
1500				
2200				
3300				
4700				
6800				
0.01 $\mu$ F				
0.015				
0.022				
0.033				
0.047				
0.068				
0.10				
0.15				
0.22				
0.33				
0.47				
0.68				
1.0				

Y5V Dielectric

CAP.	SIZE CODE 15		SIZE CODE 20	
	25 V	50 V	25 V	50 V
0.01 $\mu$ F				
0.015				
0.022				
0.033				
0.047				
0.068				
0.10				
0.15				
0.22				
0.33				
0.47				
0.68				
1.0				

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ORDERING INFORMATION

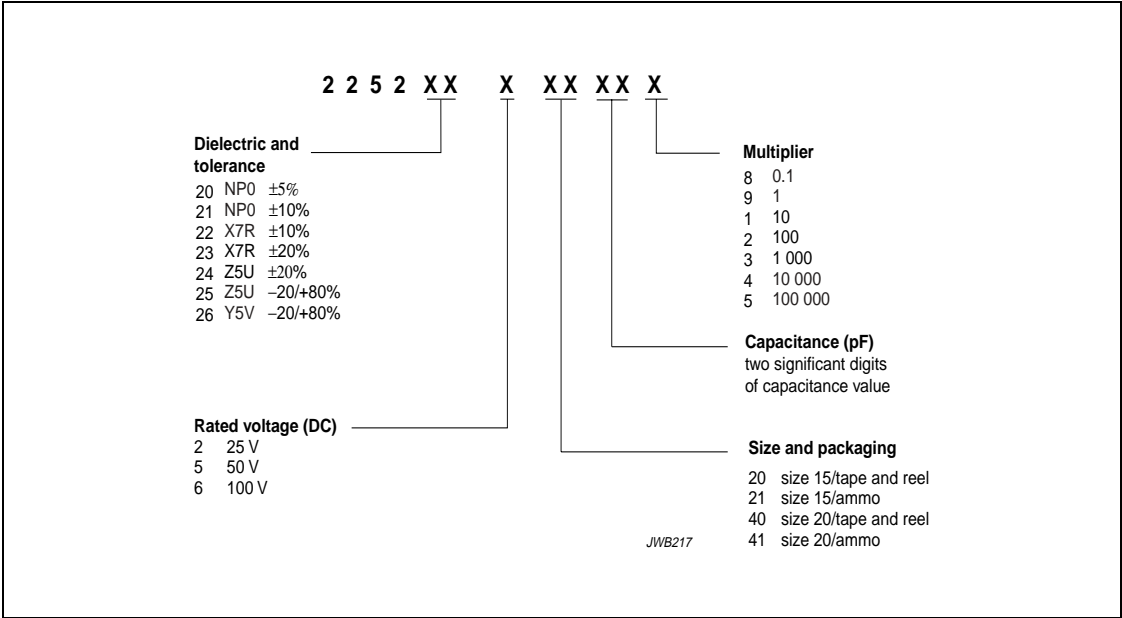
Components may be ordered by using either a simple 15-digit clear text code, or BCcomponents 12NC.

Clear text code

EXAMPLE: A103K15X7RF5TAA

PRODUCT TYPE	CAPACITANCE (pF)	TOLERANCE	SIZE CODE (mm)	DIELECTRIC	RATED VOLTAGE	LEAD DIA. (mm)	PACKAGING
A = mono-axial	two significant digits followed by the number of zeros: 101 = 100 103 = 10000	J = ±5% K = ±10% M = ±20% Z = +80%/–20%	15 = 3.8 (.150") max. 20 = 5.0 (.200") max.	COG (NP0) X7R Z5U Y5V	E = 25 V F = 50 V H = 100 V	5 = 0.5 (0.020") max.	TAA = tape & reel UAA = ammopack

Ordering code 12NC



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**Table 2** Capacitance, rated voltage, mechanical dimensions and ordering information

C	U <sub>R(DC)</sub> (V)	SIZE CODE	CLEAR TEXT CODE	CATALOGUE NUMBER
<b>NP0 (C0G) ±5% tolerance</b>				
10 pF	50	15	A100J15C0GF5UAA	2252 205 21109
	100	15	A100J15C0GH5UAA	2252 206 21109
12 pF	50	15	A120J15C0GF5UAA	2252 205 21129
15 pF	50	15	A150J15C0GF5UAA	2252 205 21159
18 pF	50	15	A180J15C0GF5UAA	2252 205 21189
22 pF	50	15	A220J15C0GF5UAA	2252 205 21229
	100	15	A220J15C0GH5UAA	2252 206 21229
27 pF	50	15	A270J15C0GF5UAA	2252 205 21279
33 pF	50	15	A330J15C0GF5UAA	2252 205 21339
39 pF	50	15	A390J15C0GF5UAA	2252 205 21399
47 pF	50	15	A470J15C0GF5UAA	2252 205 21479
	100	15	A470J15C0GH5UAA	2252 206 21479
56 pF	50	15	A560J15C0GF5UAA	2252 205 21569
68 pF	50	15	A680J15C0GF5UAA	2252 205 21689
82 pF	50	15	A820J15C0GF5UAA	2252 205 21829
100 pF	50	15	A101J15C0GF5UAA	2252 205 21101
	100	15	A101J15C0GH5UAA	2252 206 21101
150 pF	50	15	A151J15C0GF5UAA	2252 205 21151
220 pF	50	15	A221J15C0GF5UAA	2252 205 21221
	100	15	A221J15C0GH5UAA	2252 206 21221
330 pF	50	15	A331J15C0GF5UAA	2252 205 21331
470 pF	50	15	A471J15C0GF5UAA	2252 205 21471
	100	15	A471J15C0GH5UAA	2252 206 21471
680 pF	50	15	A681J15C0GF5UAA	2252 205 21681
1000 pF	50	15	A102J15C0GF5UAA	2252 205 21102
	100	20	A102J20C0GH5UAA	2252 206 41102
1500 pF	50	15	A152J15C0GF5UAA	2252 205 21152
2200 pF	50	15	A222J15C0GF5UAA	2252 205 21222
3300 pF	50	20	A332J20C0GF5UAA	2252 205 41332
4700 pF	50	20	A472J20C0GF5UAA	2252 205 41472
5600 pF	50	20	A562J20C0GF5UAA	2252 205 41562

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C	U <sub>R(DC)</sub> (V)	SIZE CODE	CLEAR TEXT CODE	CATALOGUE NUMBER
<b>X7R ±10% tolerance</b>				
100 pF	50	15	A101K15X7RF5UAA	2252 225 21101
	100	15	A101K15X7RH5UAA	2252 226 21101
150 pF	50	15	A151K15X7RF5UAA	2252 225 21151
	100	15	A151K15X7RH5UAA	2252 226 21151
220 pF	50	15	A221K15X7RF5UAA	2252 225 21221
	100	15	A221K15X7RH5UAA	2252 226 21221
330 pF	50	15	A331K15X7RF5UAA	2252 225 21331
470 pF	50	15	A471K15X7RF5UAA	2252 225 21471
	100	15	A471K15X7RH5UAA	2252 226 21471
680 pF	50	15	A681K15X7RF5UAA	2252 225 21681
1000 pF	50	15	A102K15X7RF5UAA	2252 225 21102
	100	15	A102K15X7RH5UAA	2252 226 21102
1500 pF	50	15	A152K15X7RF5UAA	2252 225 21152
2200 pF	50	15	A222K15X7RF5UAA	2252 225 21222
	100	15	A222K15X7RH5UAA	2252 226 21222
3300 pF	50	15	A332K15X7RF5UAA	2252 225 21332
4700 pF	50	15	A472K15X7RF5UAA	2252 225 21472
	100	15	A472K15X7RH5UAA	2252 226 21472
6800 pF	50	15	A682K15X7RF5UAA	2252 225 21682
0.01 µF	50	15	A103K15X7RF5UAA	2252 225 21103
	100	15	A103K15X7RH5UAA	2252 226 21103
0.015 µF	50	15	A153K15X7RF5UAA	2252 225 21153
0.022 µF	50	15	A223K15X7RF5UAA	2252 225 21223
	100	15	A223K15X7RH5UAA	2252 226 21223
0.033 µF	50	15	A333K15X7RF5UAA	2252 225 21333
0.047 µF	50	15	A473K15X7RF5UAA	2252 225 21473
	100	20	A473K20X7RH5UAA	2252 226 41473
0.068 µF	50	15	A683K15X7RF5UAA	2252 225 21683
0.1 µF	50	15	A104K15X7RF5UAA	2252 225 21104
	100	20	A104K20X7RH5UAA	2252 226 41104



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C	U <sub>R(DC)</sub> (V)	SIZE CODE	CLEAR TEXT CODE	CATALOGUE NUMBER
<b>Z5U ±20% tolerance</b>				
1000 pF	50	15	A102M15Z5UF5UAA	2252 245 21102
	100	15	A102M15Z5UH5UAA	2252 246 21102
2200 pF	50	15	A222M15Z5UF5UAA	2252 245 21222
4700 pF	50	15	A472M15Z5UF5UAA	2252 245 21472
0.01 µF	50	15	A103M15Z5UF5UAA	2252 245 21103
	100	15	A103M15Z5UH5UAA	2252 246 21103
0.022 µF	50	15	A223M15Z5UF5UAA	2252 245 21223
0.047 µF	50	15	A473M15Z5UF5UAA	2252 245 21473
0.1 µF	50	15	A104M15Z5UF5UAA	2252 245 21104
	100	20	A104M20Z5UH5UAA	2252 246 41104
0.22 µF	50	15	A224M15Z5UF5UAA	2252 245 21224
0.47 µF	50	20	A474M20Z5UF5UAA	2252 245 41474
0.68 µF	50	20	A684M20Z5UF5UAA	2252 245 41684
1.00 µF	50	20	A105M20Z5UF5UAA	2252 245 41105
<b>Y5V +80/–20% tolerance</b>				
0.01 µF	50	15	A103Z15Y5VF5UAA	2252 265 21103
0.022 µF	50	15	A223Z15Y5VF5UAA	2252 265 21223
0.047 µF	50	15	A473Z15Y5VF5UAA	2252 265 21473
0.1 µF	25	15	A104Z15Y5VE5UAA	2252 262 21104
	50	15	A104Z15Y5VF5UAA	2252 265 21104
0.22 µF	25	20	A224Z20Y5VE5UAA	2252 262 41224
	50	20	A224Z20Y5VF5UAA	2252 265 41224
0.47 µF	25	20	A474Z20Y5VE5UAA	2252 262 41474
	50	20	A474Z20Y5VF5UAA	2252 265 41474
1.0 µF	25	20	A105Z20Y5VE5UAA	2252 262 41105

## Leaded ceramic multilayer capacitors

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### ELECTRICAL CHARACTERISTICS

**Table 3** Electrical data for NPO, X7R, Z5U and Y5V

The capacitors meet the essential requirements of "EIA 198".

Unless stated otherwise all electrical values apply at an ambient temperature of  $25 \pm 3$  °C, at barometric pressures of 650 to 800 mm of mercury, and relative humidity not to exceed 75%.

DESCRIPTION	VALUE
<b>Capacitors with temperature coefficient NPO</b>	
Capacitance range: at 1 MHz, 1 V; where $C \leq 1000$ pF at 1 kHz, 1 V; where $C > 1000$ pF	10 to 1000 pF 1200 to 5600 pF
Tolerance on the capacitance	$\pm 5\%$ ; $\pm 10\%$
Rated DC voltage	50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	100 000 M $\Omega$ or 1000 M $\Omega \times \mu\text{F}$ , whichever is less at rated voltage within 2 minutes of charging
Temperature coefficient of the capacitance	$0 \times 10^{-6}/\text{K}$
Tolerance on the temperature coefficient	$\pm 30 \times 10^{-6}/\text{K}$
Dissipation factor:  at 1 MHz, 1 V; where $C \leq 30$ pF at 1 kHz, 1 V; where $C > 30$ pF	$< \frac{1}{(400 + 20 \times C)}$ $< 15 \times 10^{-4}$
Operating temperature range	$-55$ to $+125$ °C
Storage temperature range	$25 \pm 15$ °C
<b>Capacitors with temperature coefficient X7R</b>	
Capacitance range at 1 kHz, 1 V	100 pF to 0.22 $\mu\text{F}$
Tolerance on the capacitance	$\pm 10\%$ ; $\pm 20\%$
Maximum capacitance change with respect to capacitance value at 25 °C	$\pm 15\%$
Rated DC voltage	50 V and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	100 000 M $\Omega$ or 1000 M $\Omega \times \mu\text{F}$ , whichever is less at rated voltage within 2 minutes of charging
Dissipation factor at 1 kHz, 1 V	$\leq 2.5\%$
Operating temperature range	$-55$ to $+125$ °C
Storage temperature range	$25 \pm 15$ °C
Ageing	typical 1% per time decade

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DESCRIPTION	VALUE
<b>Capacitors with temperature coefficient Z5U</b>	
Capacitance range at 1 kHz, 0.5 V	1 000 pF to 1.00 $\mu$ F
Tolerance on the capacitance	$\pm 20\%$ ; $+80\%$ / $-20\%$
Maximum capacitance change with respect to capacitance value at 25 °C	$+22\%$ / $-56\%$
Rated DC voltage	50 and 100 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	10 000 $M\Omega$ or $1000 M\Omega \times \mu F$ , whichever is less at rated voltage within 2 minutes of charging
Dissipation factor at 1 kHz, 0.5 V	$\leq 4\%$
Operating temperature range	10 to 85 °C
Storage temperature range	25 $\pm 15$ °C
Ageing	typical 6% per time decade
<b>Capacitors with temperature coefficient Y5V</b>	
Capacitance range at 1 kHz, 1 V	0.01 to 1.0 $\mu$ F
Tolerance on the capacitance	$+80\%$ / $-20\%$
Maximum capacitance change with respect to capacitance value at 25 °C	$+22\%$ / $-82\%$
Rated DC voltage	25 V and 50 V
Dielectric strength	250% of rated voltage
Insulation resistance at rated voltage	10 000 $M\Omega$ or $1000 M\Omega \times \mu F$ , whichever is less at rated voltage within 2 minutes of charging
Dissipation factor at 1 kHz, 1 V	$\leq 5\%$
Operating temperature range	$-30$ to $+85$ °C
Storage temperature range	25 $\pm 15$ °C
Ageing	typical 6% per time decade

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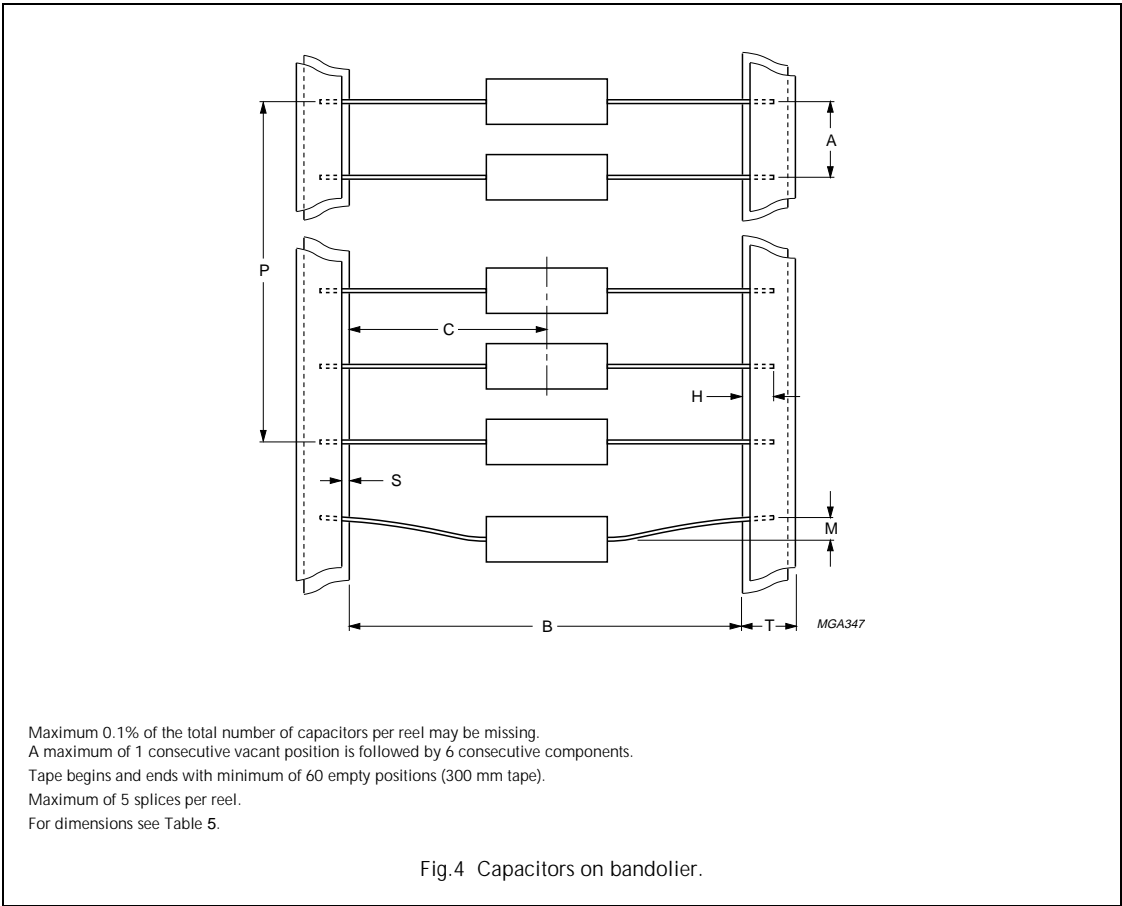
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PACKAGING

Table 4 Packaging quantities and box dimensions; see Fig.6

PACKAGING	SIZE CODE	SMALLEST PACKAGING QUANTITY (SPQ)	BOX DIMENSIONS L × W × H (mm)
Tape on reel	15; 20	7000	370 × 370 × 90
Ammopack	15; 20	4000	265 × 85 × 95

Capacitors on bandolier



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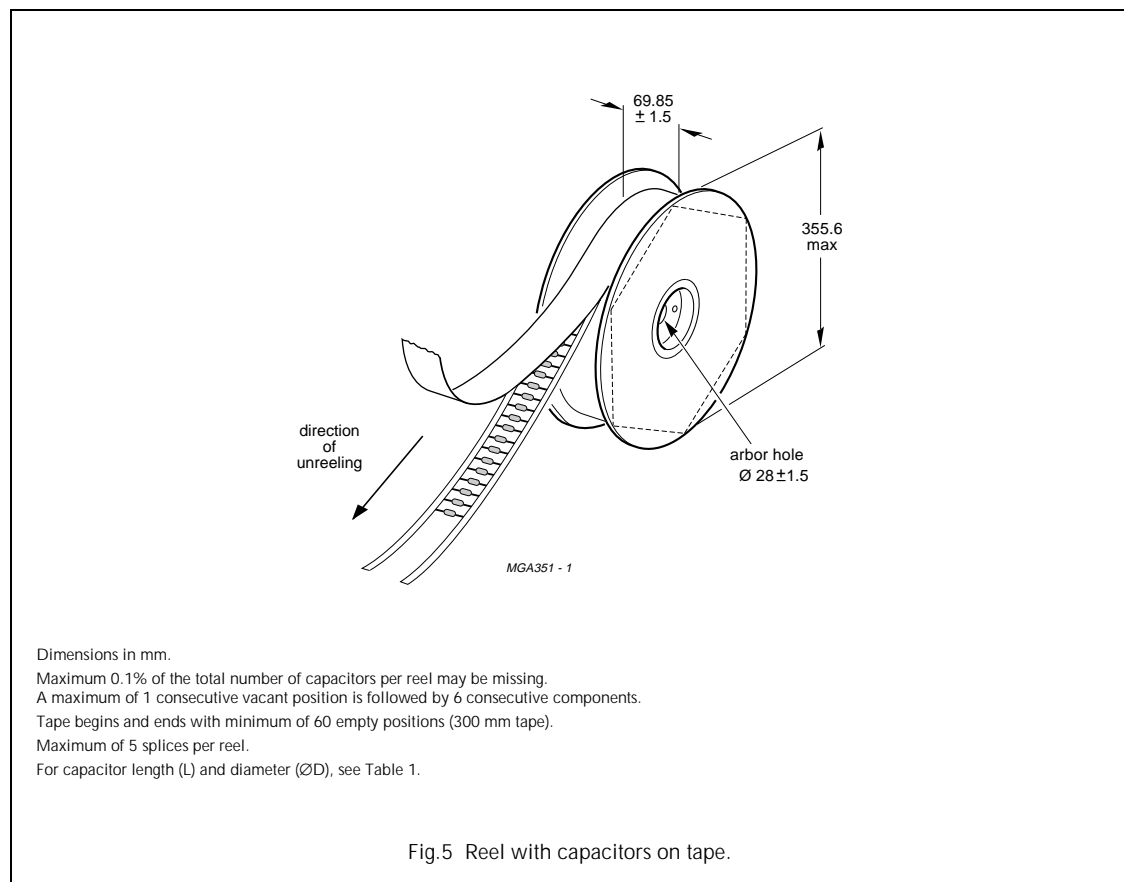
**Table 5** Dimensions of bandolier; see Fig.4

SYMBOL	PARAMETER	DIMENSIONS	
		mm	inch
B <sup>(1)</sup>	inside tape spacing	52.4 ±1.5	2.062 ±0.059
C	centre-to-tape-spacing	±0.8	±0.031
P	cumulative pitch, 6 consecutive components	±1.5	±0.059
A	components pitch	5 ±0.5	0.197 ±0.015
M	lead bend	<1.2	<0.047
S	exposed adhesive	<0.51	<0.020
T	tape width	6.35	0.250
H	lead sandwich	>3.96	>0.156

### Note

1. Inside tape spacing 26.0 +1.51/−0.0 is available on request.

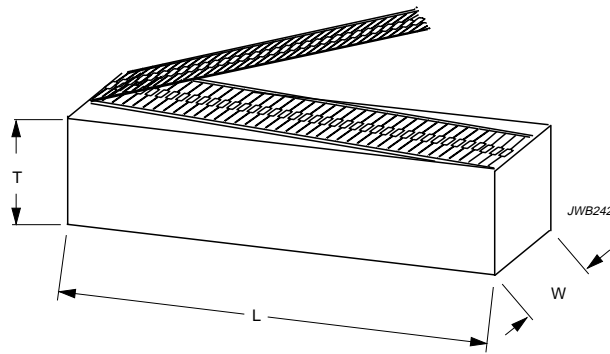
### REEL DATA



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### AMMOPACK DATA



Dimensions in mm.

Maximum 0.5% of the total number of capacitors per box may be missing.

A maximum of 2 consecutive vacant positions is followed by 6 consecutive components.

Tape begins and ends with minimum of 24 empty positions (300 mm tape).

Maximum of 5 splices per box.

Cumulative pitch tolerance over 20 consecutive units not to exceed  $\pm 1.0$  mm.

Lead space (F) shall be measured at  $3.6 \pm 0.5$  mm from the capacitor seating plane.

For dimensions see Table 4.

Fig.6 Ammopack with capacitors on tape.